

REMARKS

The Office Action fails to include claims 25-28 as pending in the application. Applicants believe that this omission was inadvertent and request that appropriate correction be made.

Claims 1 and 19 are amended to more particularly point out that the ground plane is disposed between the heating device, on one side, and the pump cell, the reference cell and the sensor chamber, on the other side, which are collectively referred to as a gas sensing arrangement, as shown in Fig. 1.

The amendments merely serve to clarify the location of the ground plane electrode, as is well known in the art. As discussed herein, the prior art fails to suggest a ground plane adapted for measuring temperature, and so does not show the claimed invention prior to the amendments, although it is believed to be made clearer by the amendments. Thus, the amendments do not add new matter or raise new issues so as to necessitate further search. In the event that the claims are still not deemed in condition for allowance, it is requested that the amendments be entered nevertheless, if only for purposes of appeal.

Claim Rejection under 35 USC § 103

Claims 1, 2, 4-19, 21, 23 and 24 were rejected under 35 U.S.C. § 103 as unpatentable over the Admitted Prior Art in view of United States Patent No. 5,989,398, issued to Young et al. in 1999; United States Patent No. 4,417,470, issued to McCracken

et al. in 1983; and United States Patent No. 5,562,811, issued to Lenfers in 1996.

In view of the omission of claims 25-28, for purposes of this response, Applicants have assumed that claims 25-28 would have been included in the rejection.

The rejection points to the Admitted Prior Art described in the Background of the application. In an oxygen sensor, it is known to arrange a pump cell, reference cell and sensor chamber. It is also known to provide a heater to raise the temperature of the sensor to a preferred range. It is also known to provide a ground plane to isolate the electrodes of the cells from the electromagnetic noise created by the electrical current to the heater. In Applicants' invention, the ground plane is designed also to measure the temperature of the sensor. For this purpose, the ground plane includes leads, referred to as the measuring leads, that have a large surface area to provide the desired shielding of the heater device. The measuring leads are connected by a thin portion, referred to as the sensing portion, which exhibits a significant change in resistance as a function of temperature. Thus, the temperature of the sensor may be determined by measuring the resistance of the ground plane.

The prior art, including the three references cited in the rejection, does not teach or suggest an oxygen gas sensor having a ground plane configured to measure temperature, as in Applicants' invention.

Young et al. describes a sensor for detecting hydrocarbon species. Referring sensor 1 in Fig. 3, the operating temperature is mainly set by primary heaters 58 and 62,

col. 6, lines 21-23. Measurements are made by detecting the differences in temperatures between thermometers 46a and 46b, col. 6, lines 23-26. Compensation heaters 50a and 50b provide minor incremental heat to compensate for variations in the temperatures of the sensing elements 34a and 34b due to exothermic oxidation reactions, as determined by thermometers 46a and 46b. It is significant that the sensor includes a ground plane 54 to isolate the thermometers and compensation heaters from the electrical noise of the primary heaters 58 and 62, col. 5, line 64, to col. 6, line 3. It is also significant that temperature measurement is made by thermometers 46a and 46b that are separate and distinct from the ground plane 54. Thus, in contrast to Applicants' invention, the ground plane is not adapted for temperature measurement. Although the sensing elements in Young et al. do not include electrical circuitry that would require shielding from heaters 50a or 50b, it is nevertheless noted that the thin traces used for the thermometers would not be effective to provide such shielding. Thus, Young et al. does not show a ground plane adapted for temperature measurement, or a thermometer adapted for electrical shielding the heater elements. Without these features, Young et al. does not teach or suggest Applicants' invention.

McCracken et al. describes a temperature sensor, but does not include heating circuit or other circuitry, such the circuitry for gas detection in Applicants' sensor. Thus, McCracken et al. does not need or include a ground plane, and does not adapt the temperature sensor to shield noise from a heater, key features of Applicants' invention.

Lenfers describes an oxygen sensor that is readily distinguished from Applicants'

invention. First, Lenfers determines sensor temperature by measuring the electrical resistance of the electrodes of the pump and reference cells, see beginning at col. 3, line 60. Second, in Lenfers, heating element 44 is separated from electrode 30 only by insulating layer 42, col. 3, lines 20-34. That is, the sensor does not include a ground plane shielding the sensor electrodes from the heater. Thus, Lenfers does not show Applicants' invention.

Thus, even when combined, the references do not lead to Applicants' invention. In the prior art, the ground plane and temperature sensor are separate and distinct elements. This is also shown in Young et al. McCracken et al. and Lenfers do not provide ground planes. Thus, even when considered together, there is nothing to point the practitioner to adapt the ground plane that shields the heating element, so as to carry out the additional function of temperature measurement, so as to arrive at Applicants' invention.

Claim 1 is directed to Applicants' planar oxygen sensor that includes a pump cell, a reference cell and a sensor chamber, collectively referred to as a gas sensing arrangement. The claim further calls for a heating device and a ground plane electrode located between the heating device and the gas sensing arrangement. The ground plane electrode includes measuring leads having increased surface area, consistent with the function of the ground plane electrode in isolating the heating device. The ground plane electrode further includes a sensing portion, useful in measuring temperature. The claim also calls for a temperature measurement device communicating with the measuring

leads. The prior art, as shown in Young et al., provides separate ground planes and temperature measuring elements. McCracken et al. and Lenfers do not provide ground planes, and so cannot suggest adapting the ground plane to sense temperature. Thus, the prior art does not point to Applicants' sensor in claim 1.

Claims 2 and 4-18 are dependent upon claim 1 and so not taught or suggested by the prior art for the reasons set forth with regard to that claim.

Claim 19 is directed to Applicants' method for measuring temperature in an oxygen sensor that includes a ground plane electrode having a sensing portion and first and second measuring leads, features similar to claim 1. Also like claim 1, the ground plane electrode is disposed between the heating device and the arrangement of the pump cell, the reference cell and the sensor chamber. The claim further calls for communicating the first and second measuring leads with the terminals of a temperature measuring device, and measuring the resistance between the measuring leads. The prior art does not show an oxygen sensor that includes a ground plane between the heater and the gas sensing elements and having leads connected to a temperature measurement device. Therefore, the prior art does not teach or suggest Applicants' method in claim 19, or in claims 21 and 23-28 dependent thereon.

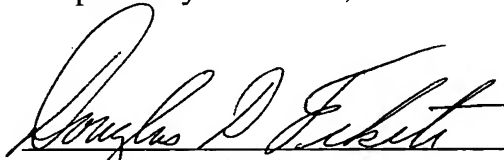
Accordingly, it is respectfully requested that the rejection of claims 1, 2, 4-19, 21, and 23-28 based upon the prior art be reconsidered and withdrawn, and that the claims be allowed.

Conclusion

It is believed, in view of the amendments and remarks herein, that all grounds of rejection of the claims have been addressed and overcome, and that all claims are in condition for allowance. If it would further prosecution of the application, the Examiner is urged to contact the undersigned at the phone number provided.

The Commissioner is hereby authorized to charge any fees associated with this communication to Deposit Account No. 50-0831.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Douglas D. Fekete", written over a horizontal line.

Douglas D. Fekete
Reg. No. 29,065
Delphi Technologies, Inc.
Legal Staff – M/C 480-410-202
P.O. Box 5052
Troy, Michigan 48007-5052

(248) 813-1210